REMARKS

Claims 1-11 were pending. Claims 1, 7, and 8 have been amended. Claim 6 has been canceled. Accordingly, claims 1-5 and 7-11 are presently pending.

Claims 1-11 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Claims 1 and 7 have been amended as required by the Examiner. The amended claims are submitted to particularly point out and distinctly claim the subject matter of the invention.

Claims 1, 6-8, and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Pat. No. 5,000,926 to Murayama et al., in view of U.S. Pat. No. 5,520,891 to Lee. This rejection is traversed.

Amended claim 1 recites a process for preparing ammonia by contacting an ammonia synthesis gas with an ammonia synthesis catalyst arranged as a reaction zone in one or more catalyst tubes. The reaction zone is cooled by a heat conducting relationship with a cooling agent, and an ammonia rich effluent stream is withdrawn from the reaction zone. The cooling agent is selected from eutectic mixtures of potassium nitrate, sodium nitrate, and sodium nitrite, eutectic mixtures of sodium hydroxide and potassium hydroxide, and metals having a melting point below the temperature in the reaction zone. The cooling agent circulates within cooling tubes, each cooling tube concentrically surrounding one catalyst tube.

Murayama et al. discloses a reactor in which a plurality of feed tubes 4, surrounded concentrically by catalyst tubes 6, is arranged in a shell 10 containing a cooling medium. The cooling medium flows into the shell 10 through tube 19 and out through tube 20. The crux of the invention disclosed by Murayama et al. is the co-current flow of feed inside the catalyst tubes, which avoids extreme inlet temperatures. Murayama et al. does not teach or suggest an ammonia preparation process that includes circulating a cooling agent within cooling tubes concentrically surrounding respective catalyst tubes.

Lee does not cure the deficiencies of Murayama et al. Lee discloses a cross-flow reactor in which a heat exchange medium is circulated within internal tubes 54 embedded in an active zone 41 of a catalyst bed 11. Lee does not teach or suggest an ammonia preparation process in which a cooling agent is circulated within cooling tubes, each surrounding concentrically one catalyst tube.

Moreover, Lee does not provide the suggestion or motivation needed to combine the two references, or to modify Murayama et al. as would be necessary to obtain the process recited in claim 1. Simply replacing the cooling medium of Murayama et al. with that of Lee does not result in the present invention. The Examiner has not explained how Lee could be relied upon to modify Murayama et al. to arrive at the process as recited in amended claim 1. Claim 1 and its dependent claims 2-5 and 9-11 are submitted as patentable over the cited references to Murayama et al. and Lee.

Amended claim 7 recites a converter for the preparation of ammonia. The converter has catalyst tubes adapted to receive ammonia synthesis gas and to hold a reaction zone of ammonia synthesis catalyst. A cooling tube concentrically surrounds each catalyst tube. Each cooling tube is adapted to hold the cooling agent selected from eutectic mixtures of potassium nitrate, sodium nitrate, and sodium nitrite, eutectic mixtures of sodium hydroxide and potassium hydroxide, and metals having a melting point below the temperature in the reaction zone.

Murayama et al. discloses a reactor having feed tubes 4 surrounded concentrically by catalyst tubes 6. The feed tubes and catalyst tubes are arranged inside a shell 10 containing the cooling medium. The cooling medium flows into the shell 10 through tube 19 and out through tube 20. The invention disclosed by Murayama et al. relies on co-current flow of feed inside the catalyst tubes to reduce extreme feed inlet temperatures. Murayama et al. does not teach or suggest a converter in which a cooling agent is circulated within cooling tubes, each cooling tube surrounding concentrically one catalyst tube.

Lee does not cure the deficiencies of Murayama et al. Lee discloses a cross-flow reactor in which a heat exchange medium is circulated within internal tubes 54 embedded in an active zone 41 of a catalyst bed 11. Lee does not teach or suggest a converter in which a cooling agent is circulated within cooling tubes, each surrounding concentrically one catalyst tube.

Moreover, Lee does not provide the requisite suggestion or motivation to combine the references or to modify Murayama et al. as would be needed to arrive at the present invention. Therefore, claim 7 and its dependent claim 8 are submitted as patentable over the cited references to Murayama et al. and Lee.

Claims 3, 9, and 10 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Murayama et al. in view of Lee '891, further in view of U.S. Pat. No. 5,032,364 to Pinto or U.S. 1,931,678 to Porter. This rejection is traversed.

Claims 3, 9, and 10 depend from claim 1, which is submitted as patentable over the cited references to Murayama et al. and Lee. Neither Pinto nor Porter cures the deficiencies of Murayama et al. and Lee. Pinto and Porter have been cited as disclosing recycling a stream of unconverted ammonia synthesis gas to the reaction zone. Pinto and Porter do not teach or suggest a process for the preparation of ammonia that includes cooling the reaction zone using a cooling agent circulated within cooling tubes surrounded concentrically by respective catalyst tubes. Accordingly, claims 3, 9, and 10 are submitted as being patentable over the cited references to Murayama et al., Lee, Pinto, and Porter.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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Respectfully submitted,

By _____

Stephen A. Soffen
Registration No.: 31,063
Peter F. McGee
Registration No.: 35,947
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP
2101 L Street NW
Washington, DC 20037-1526
(202) 785-9700
Attorney for Applicant